

The Fundamental Problems of the Spectroscopy of
Dispersing Media.

48-11-3/13

theories relating to this problem: 1) General theory for a homogeneous light-dispersing layer and for diffuse illumination. 2) Theories of Gurevich, Gershun, Kubelka, Munk, a. o. 3) Transport-theory, 4) Theory based upon the molding of the light-dispersing layer, by Antonov-Romanovskiy, Stepanov, Girin, Bodo, Chekalinskaya. A comparison of all these theories shows that they have much in common, but that they are also very different. Each of them can be applied in different cases, but none of them is enabled either to explain or to express the dispersion of the inciding non-diffuse irradiation at the incidence on an intensively absorbing or intensively dispersing medium. They can be applied at times, but then it is connected with a coarse approximation. There are 1 figure, and 28 references, 16 of which are Slavic.

ASSOCIATION: Institute of Physics and Mathematics AN Belorussian SSR (Institut fiziki i matematiki Akademii nauk BSSR).

AVAILABLE: Library of Congress.

Card 2/2

STEPANOV, B.I.

S.I. Vavilov's works in the field of luminescence. Uch.zap.BGU
no.32:17-24 ' 57. (MIRA 11:12)
(Luminescence)

GOL'MAN, L.P.; STEPANOV, B.I.

Tables of reflection coefficients of absorbing media. Uch.zap.
(MIRA 11:12)
BGU no.32:183-206 '57.
(Reflection (Optics)--Tables, etc.)

PA -2249

AUTHOR
TITLE

PERIODICAL

ABSTRACT

STEPANOV, B.I.

Universal Relation between the Absorption Spectra and Luminescence Spectra of Complex Molecules (Universal'noye sootnosheniye mezhdu spektrami pogloshcheniya i lyuminiscentii slozhnykh molekul). Doklady Akademii Nauk SSSR, 1957, Vol 112, Nr 5, pp 839-841 (U.S.S.R.)
Reviewed 5/1957
Received 4/1957

The present paper shows that such a universal relation applies in the case of many complicated molecules. By means of this relation the shape of the luminescence-spectrum can be calculated if the shape of long-wave absorption bands is known, and vice versa. As an example the author here investigates the luminescence of the solution of an arbitrary coloring substance. Between the absorption of light and the luminescence there occurs a new distribution of oscillation energy among the different oscillation degrees of freedom of the incited molecule, as well as an exchange of energy between the incited molecule and the molecules of the solvent. This process takes place extremely rapidly and after 10^{-10} - 10^{-12} sec. an equilibrium-like distribution of oscillation-energy over the degrees of freedom and the oscillation levels of the incited molecules occurs. The shape of this distribution is fully determined by the temperature of the solvent. For the dependence of the efficiency of the luminescence of a complicated molecule on frequency a formula is given here. Furthermore, the function of distribution over the oscillation-levels of energy is written down. The absorption efficiency

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PA - 2249

Universal Relation between the Absorption Spectra and Luminescence Spectra of Complex Molecules.

APPROVED FOR RELEASE: 08/25/2000

CIA-RDP86-00513R001653130009-3"

cy is in general composed of two summands: the first, connected with absorption in the case of transition of a molecule to the incited electron-state, the second determines the absorption connected with the transitions between the oscillation-levels of the main electron-state (non-inciting absorption). The second term is, as a rule, very small and was taken into account only in connection with anti-Stokes fluorescence. For the ratio mentioned in the title an expression is explicitly written down, explained in short, and compared with Kirchhoff's law for the thermal radiation of this system. The efficiency of luminescence is proportional to the efficiency of the thermal radiation of the system. The proportionality-factor depends in the case of a given molecule only on temperature and on the incitation conditions of luminescence but not on frequency. In the case of an assumed temperature the contour of luminescence-band is identical with the contour of the band of thermal emission. The relations given here are very general; exceptional cases for which they do not apply are mentioned. (1 illustration)
White Russian State University "V.I. LENIN".

ASSOCIATION
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Card 2/2

4. 6. 1956
Library of Congress

Stepanov, B.I.

PA - 2334

AUTHOR:

KAZACHENKO, L.P., STEPANOV, B.I., Member of the Academy of Science of the White Russian SSR.

TITLE:

On the Outline of Absorption and Luminescence Bands in the Spectra of Complex Molecules. (O konture polos pogloshcheniya i luministsentsii slozhnykh molekul, Russian).

PERIODICAL:

Doklady Akademii Nauk SSSR, 1957, Vol 112, Nr 6, pp 1027 - 1029, (U.S.S.R.)

Received: 4 / 1957

Reviewed: 5 / 1957

ABSTRACT:

In the present work a general relation is derived which connects the value of the absorption coefficient or of the amount of emission for the frequencies $\nu > \nu_{el}$ with the values of the same quantities for the frequencies $\nu < \nu_{el}$. These results can be

applied only in the case of such molecules in the case of which the mirror symmetry of the absorption and luminescence spectra discovered by LEVSHIN are observed. The derivation is followed up step by step and finally the following formula is obtained:

$$\chi_{\nu_{el} - \Delta\nu} / (\chi_{\nu_{el}} - \Delta\nu) = (\chi_{\nu_{el} + \Delta\nu} / (\chi_{\nu_{el}} + \Delta\nu)) e^{-h \Delta\nu / kT}$$

An analogous dependence is obtained for the edge of the luminescence band. The expressions given here are of a very general nature and can be incorrect only in the case of such molecules, as show derivations from the mirror symmetry of the absorption and luminescence spectra. They can also not be applied in those

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On the Outline of Absorption and Luminescence Bands in the Spectra of complex molecules.

cases in which no equilibrium-like distribution on the oscillation levels can occur after the molecules have remained in the excited electronic state.

For the purpose of examining the relations derived here the authors used experimental data concerning the spectra of the phthalimides which are here given in a table. The same table contains the results of the computations for the absorption of a 3-aminophthalimide-solution. According to this comparison the formula mentioned above agrees well with the experiment. The same formula can be transformed so as to be better suited for comparison with the experiment:

$$\ln(\mathcal{R}_{\nu_{el} + \Delta\nu} / (\nu_{el} + \Delta\nu)) - \ln(\mathcal{R}_{\nu_{el} - \Delta\nu} / (\nu_{el} - \Delta\nu)) = h\Delta\nu / kT$$

A diagram illustrates the values of $\ln(\mathcal{R}_{\nu} / \nu)$ as functions of ν/kT for the absorption spectrum of a solution of 3-aminophthalimide in benzol. The here given diagram is suited for determination of ν_{el} from a single absorption band without measuring the luminescence spectrum. Analogous computations and constructions for some phthalimides showed that the formula given first is always satisfied either rigorously or by approximation. The best results were obtained for the case of absorption, less good results in the case of luminescence. Noticeable changes of mirror symmetry cause no con-

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On the Outline of Absorption and Luminescence Bands in the Spectra of Complex Molecules.

siderable change of the formula given first.

(for illustration and 1 table).

APPROVED FOR RELEASE: 08/25/2000

CIA-RDP86-00513R001653130009-3"

ASSOCIATION: White Russian State University "V.I.LENIN"

PRESENTED BY:

SUBMITTED: 4.6.1956

AVAILABLE: Library of Congress.

Card 3/3

STEPANOV, B.I.

20-3-18/59

AUTHORS:

Stepanov, B.I., Member of the AN Belorussian SSR, Apanasevich, P.A.

TITLE:

The Natural Contour of Energy Levels (Yestestvennyy kontur urov-

AUTHORS: Stepanov, B. I., Member of the Belorussian Academy of Sciences, Khvashchevskaya, Ya. S. 20-4-17/51

TITLE: Note on the Determination of Absorption Spectra With the Help of Cold Sources of Light (Polucheniye spektrov pogloshcheniya s pomoshch'yu kholodnykh istochnikov sveta).

PERIODICAL: Doklady AN SSSR, 1957, Vol. 116, Nr 4, pp. 588-590 (USSR).

ABSTRACT: The customary scheme of the equipment for the investigation of absorption spectra is illustrated by a drawing. If all elements of this scheme have the same temperature, then the incident beam on the receiver from the source is completely compensated by the beam emitted by the receiver. The deflections of the receiver then are equal to zero. If, however, the temperature of the source is higher than the temperature of the receiver, then the beam of radiation energy in the positive direction (from the source toward the receiver) is greater than the beam in the negative direction. The receiver heats up and shows positive deflections. If the receiver cools down, it shows negative deflections. The deflections of the receiver will depend not only on the temperatures of the light source and of the receiver, but also on the properties of the cuvette and to a great extent on the absorption coefficient of the substance

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Note on the Determination of Absorption Spectra With the Help of Cold Sources of Light.

under investigation. These properties can easily be utilized for the determination of the absorption spectra with the help of cold light sources. A diagram illustrates the spectrum of nitrobenzene as recorded by the infrared spectrometer IKC - 11. Two lines illustrate the spectra of a source with positive radiation and of a source with negative radiation. A brass rod cooled down to -100°C served as a source of negative radiation. Two more curves illustrate the spectra of the same sources, if the cuvette contains nitrobenzene. A further diagram illustrates the spectra obtained by toluene under analogous conditions. The law by Buger holds for the negative beams. The results obtained here show, that in the case of experiments in the infrared spectral range the heat radiation of the receiver and of the cuvette containing the substance under investigation must be taken into consideration. A formula is deduced for the deflections of the receiver, which includes many practically important cases. The formulas deduced here show good correspondence with experimental data, and serve as a basis for the investigation of sources with negative radiation. All effects described here are only of importance in the infrared spectral range and at very high temperatures. In the visible spectral range negative beams, which may

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Note on the Determination of Absorption Spectra With the
Help of Cold Sources of Light.

20-4-17/51

occur, cannot be recorded. The absorption coefficient k can be
measured at a heating or cooling of the cuvette material without
the use of any light source at all.
There are 3 figures and 2 references, 2 of which are Slavic.

ASSOCIATION: Belorussian State University imeni V. I. Lenin (Belorusskiy
gosudarstvennyy universitet imeni V. I. Lenina).

SUBMITTED: March 15, 1957.

AVAILABLE: Library of Congress.

Card 3/3

STEPANOV, B.I.

20-5-15/48

AUTHORS: Stepanov, B. I., Member AN Belorussian
SSR, Apanasevich, P. A.

TITLE: Classification of Secondary Light Emission (0 klassifi-
katsii vtorichnogo svecheniya).

PERIODICAL: Doklady AN SSSR, 1957, Vol. 116, Nr 5, pp. 772-775 (USSR)

ABSTRACT: A primary light flow because of the interaction with atoms and molecules changes into a secondary luminescence which to a higher or lower degree reflects the properties of the substance to be investigated. Depending on the properties observed the whole transformed light is divided into photoluminescence, Rayleigh (Reley) scattering and combination scattering. The criterion of Vavilov made possible the correct classification of the radiations not corresponding with equilibrium. In literature, however, there is up to now no theoretic reasoning of this classification. In classical theory the problem of the transformation of light is reduced to the analysis of the solution of an equation of a dipole (mentioned here). The position and the contour of the band of the transformed light strongly depend on the spectral composition of the irradiating band. After the

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Classification of Secondary Light Emission.

irradiation stopped the steady luminescence disappears immediately and the afterglow occurs. Formulae are given for the duration as well as for the spectrum of this afterglow. The results calculated for a classical dipole remain also in quantum-electro-dynamics. Furthermore with quantum-electrodynamics also the other possibilities of light transforms can easily be investigated. The authors investigate here, for example, an atom which has three energy levels and which is in interaction with the medium surrounding it. The light transformed by such an atom consists of three bands. By means of a sketch the most probable processes are shown and then discussed. The theoretical analysis of the transformation of light by atoms and simple molecules shows the following: A classification of this phenomenon according to the extinction is impossible if, as usual, extinction means the decrease of yield. The classification according to the duration of extinction is not clear and sometimes can lead to wrong results. A possible classification is shortly discussed here, i.e. the importance of the various bands is shown. Only the Rayleigh (Reley) scattering can be described by means of a classical dipole. Atoms and simple molecules can change their state

Card 2/3

STEPANOV B.I.
FEDOROV, F.I.; STEPANOV, B.I., prof., red.; BARMICHEV, V., red. izd-va;
ALEKSANDROVICH, Kh., tekhn. red.
[Optics of anisotropic media] Optika anizotropnykh sred. Minsk,
Izd-vo Akad. nauk BSSR, 1958. 379 p.
(Optics, Physical) (Anisotropy) (MIRA 11:5)

STEPANOV, B.I.; KHVASHCHEVSKAYA, Ya.S.

Determining the coefficient of absorption by means of thermal
emission spectra of semitransparent plane parallel layers.
Inzh.-fiz.zhur. no.10:82-87 0 '58. (MIRA 11:11)

1. Insitut fiziki i matematiki AN BSSR i Belorusskiy gosudarstvennyy
universitet imeni V.I. Lenina, g. Minsk.
(Absorption spectra)

SOV/3775

PHASE I BOOK EXPLOITATION

Stepanov, Boris Ivanovich, Academician, Academy of Sciences BSSR

Spektral'nyy analiz (Spectrum Analysis) Minsk, 1958. 34 p. (Series: Obshchestvo
po rasprostraneniyu politicheskikh i nauchnykh znaniy Belorusskoy SSR, No. 29)
7,850 copies printed.

Ed.: V.A. Shevlak; Scientific Ed.: M.A. Yel'yashevich, Academician, Academy of
Sciences BSSR.

PURPOSE: The booklet is intended for readers interested in spectroscopy.

COVERAGE: In this popular booklet, the author gives a brief history of spectroscopy
and explains the importance of spectral analysis for the solution of practical
problems in metallurgy, machine manufacturing, chemical engineering, ore pro-
specting, medicine, and agriculture. Basic principles of spectral analysis are
outlined and illustrated by four diagrams. Examples of the practical applications
of emission spectrum analysis in Soviet industry are given. Molecular spectrum
analysis and luminescence analysis are discussed in the last two chapters. No
personalities are mentioned. There are no references.

Card ~~4/2~~
1/1

SOV/58-59-8-19035

Translated from: Referativnyy Zhurnal Fizika, 1959, Nr 8, p 282 (USSR)

AUTHORS: Stepanov, B.I., Khvashchevskaya, Ya.S.

TITLE: The Absorption of Negative Radiation Flux

PERIODICAL: Uch. zap. Belorussk. un-t, 1958, Nr 41, pp 19-26

ABSTRACT: It was shown earlier (RZhFiz, 1958, Nr 6, 14281) that, in order to measure the absorption coefficient correctly, it is necessary to make allowance for the temperature and emissive capacity not only of the light source, but also of the cell containing the material under investigation and of the radiation receiver. In the present study a general expression is given, which applies to the most diverse experimental conditions and permits the discounting of these effects. Their influence is greatest in the infrared region of the spectrum. The results of the experimental verification of the derived correlations are given. The authors record the absorption spectra of nitrobenzene and fused-quartz powder, from a source of positive radiation (a heated body), as well as from a source of "negative" radiation (a cooled body), and also when no radiation source is present but the cell

Card 1/2

STEPANOV, B.I.

Centennial of the birth of the outstanding German physicist
Max Planck. Inzh.-fiz.zhur. 1 no.8:119-120 Ag '58. (MIRA 11:8)
(Planck, Max Karl Ernst Ludwig, 1858-1947)

SOV/51-4-6-5/24

AUTHORS: Stepanov, B.I. and Prima A.M.

TITLE: Vibrational Spectra of Silicates (Kolebatel'nyye spektry silikatov)
I. Calculation of Frequencies and Intensities of Silicate Spectral
Lines (I Raschet chastot i intensivnostey liniy spektrov silikatov)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol IV, Nr 6, pp. 734-749 (USSR)

ABSTRACT: In order to investigate vibrational spectra of silicate glasses, it is necessary to study first the simpler spectra of silicate crystals. The latter consist of silicon-oxygen groups (tetrahedra, chains, layers), which are sometimes bound by atoms of metals and other elements. The present paper reports calculations of vibrational spectra of atoms in silicate crystals. All calculations were made using the method developed by Yel'yashevich and Stepanov (Ref 17) for calculation of molecular vibration frequencies. This approach made it possible to simplify the solution of the problem and to discuss various crystals using the same vibrational coordinates. All vibrations were made in the harmonic approximation, taking into account deformational and torsional vibrations. Time equations were obtained for vibrations of various types of symmetry. All these calculations are not difficult

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SOV/51-4-6-5/24

Vibrational Spectra of Silicates. I. Calculation of Frequencies and Intensities of Silicate Spectral Lines

but are very cumbersome. For this reason the authors give in their paper only the main results which apply to valency vibrations. Details and results of calculations for deformational vibrations are given elsewhere (Refs 19, 20). The authors obtained frequencies, forms of normal vibrations, intensities and polarizations of vibrational lines of the following silicate crystals: pyroxenes (structure is shown in Fig 1), SiO_4 tetrahedra joined into an infinite layer (as shown in Fig 2), β -cristobalite (structure is shown in Fig 3) and β -quartz (structure is shown in Fig 4). Figs 5 and 6 show the infrared and Raman spectra calculated for all the silicates mentioned above. The height of the lines corresponds to the relative values of intensities calculated for random distributions of chains, layers and crystallites, of cristobalite and quartz, i.e. for glasses and strongly disordered crystals. The results of calculations shown in Figs 5 and 6 are approximate (the main approximation is due to exclusion of the effect of deformational coordinates). There are 6 figures and 23 references, 16 of which are Soviet, 2 German, 2 American, 1 French, 1 Indian and 1 translation of a Western work into Russian.

Card 2/2

ASSOCIATION: Institut Fiziki i Matematiki AN BSSR; Belorusskiy Gosudarstvennyy Universitet (Institute of Physics and Mathematics, Academy of Sciences of the Belorussian S.S.R.; Belorussian State University)
July 26, 1957

SOV/51-5-1-3/19

AUTHORS: Stepanov, B.I. and Prima, A.M.

TITLE: Vibrational Spectra of Silicates (Kolebatel'nyye spektry silikatov)
II. Interpretation of Spectra of Glasses (II. Interpretatsiya
spektrov stekol)

PERIODICAL: Optika i Spektroskopiya, 1968, Vol 5, Nr 2, pp 15-22 (USSR)

ABSTRACT: In Part I (Optika i Spektroskopiya, 1968, Vol IV, Nr 6, p 734) the authors give the results of calculations of frequencies and forms of vibrations of several silicate crystals (α -quartz, cristobalite, silicon-oxygen chains and laminae). A detailed discussion of the results of Part I is given in the present paper. These results are also used to interpret Raman and infrared spectra of silicate glasses and of certain crystals. It is shown that metasilicate and bisilicate spectra differ qualitatively. The spectra of glasses of bisilicate composition can be interpreted satisfactorily only if existence of laminar combinations of SiO_4 tetrahedra in the glass is assumed. Figs 1, 2 and 3 show the results of calculation of infrared (Figs 1a, 2a, 3a) and Raman (Figs 1b, 2b, 3b) spectra of silicate crystals. The results for crystals with chain structure of the silicon-oxygen base (pyroxene type) are given in Fig 1. The results for crystals with laminar structure (e.g. talc) are given in Fig 2 and for β -quartz

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SOV/SI-11-3/10

Vibrational Spectra of Silicates. II. Interpretation of Spectra of Glasses

in Fig 3. The height of the lines gives the relative intensities. The forbidden lines are shown dashed. The letters A_1 , A_2 , E_1 , E_2 give the type of symmetry of the normal vibrations. The authors carried out calculations only for the valence frequencies in the region 400-1200 cm^{-1} . Figs 1-3 show the results of five variants of calculations with different values of quasielastic constants, as well as experimental results. Fig 4 gives the Raman spectra of glasses of metasilicate and bisilicate composition and of fused quartz, obtained experimentally (Fig 4b), and in Fig 4a the spectra of polycrystals consisting of chains, laminae and of quartz, calculated theoretically using the 5th variant (the 5th row in Figs 1-3) are given. It is seen that the theoretical and experimental spectra agree well and it is possible to interpret the experimental results using the theory given in this paper. There are 4 figures and 15 references, 13 of which are Soviet, 1 German and 1 American.

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ASSOCIATION: Institut fiziki i matematiki AN BSSR, Belorusskiy gosudarstvennyy universitet (Institute of Physics and Mathematics of the Academy of Sciences of the Byelorussian S.S.R.; Belorussian State University)

SUBMITTED: July 26, 1967 1. Silicate crystals-Vibrations 2. Silicate crystals - Spectrographic analysis

SOV/51-5-4-7/21

AUTHORS: Stepanov, B.I. and Khvashchevskaya, Ya.S.

TITLE: Background of Thermal Radiation in Infrared Spectroscopy (Fon teplovogo izlucheniya v infrakrasnoy spektroskopii)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 4, pp 393-403 (USSR)

ABSTRACT: The authors obtained formulae which allow for the effect of thermal emission of the radiation receiver and the cell containing the substance studied in infrared spectroscopy. This emission is called a "negative radiation flux". Fig 1 shows, schematically, an infrared spectrometer. Figs 2-5 show that metals (e.g. Al, Cu, Sn) and other substances (e.g. cyclohexanol) possess emissivities at room and at low temperatures (e.g. -140°C) which must be taken into account in any complete discussion of thermal radiation balance in infrared spectroscopy. Fig 6 shows that positive and negative radiation fluxes are present also in scattering processes (scattering by MnSO_4 powder). It is shown that cold bodies may be used as light sources in determination of absorption coefficients. In determination of the temperature dependence of the absorption coefficients even emission of the cell

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SOV/51-5-4-7/21

Background of Thermal Radiation in Infrared Spectroscopy

windows has to be allowed for. The author discusses the precautions necessary in the particular cases of glycerin (Fig 7) and cyclohexane (Figs 8, 9) measurements. Allowances for the thermal radiation background in the method of determination of the absorption coefficient from emission by a plane-parallel layer (Refs 10, 11) are also discussed. There are 10 figures and 11 references, 10 of which are Soviet and 1 American.

ASSOCIATION: Institut fiziki i matematiki, AN BSSR, Belorusskiy gos. universitet im. V.I. Lenina (Institute of Physics and Mathematics, Academy of Sciences of the Byelorussian S.S.R.; Byelorussian State University imeni V.I. Lenin)

SUBMITTED: October 31, 1957

Card 2/2

1. Infrared spectroscopy--Temperature factors 2. Thermal radiation
--Properties

SOV/48-22-9-6/40

AUTHOR: Stepanov, B. I.
 TITLE: On the Agreement of the Absorption- and Luminescence-Bands
 of Molecules With Complicated Structure (O sootvzstsvii polos
 pogloshcheniya i lyuminestsentsii slozhnykh molekul)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1958,
 Vol 22, Nr 9, pp 1034 - 1037 (USSR)

ABSTRACT: In the present paper the author shows that for the
 contours of the fluorescence band and the contours of the
 long-wave absorption band a universal equation

$$W_{\nu}^{\text{lum}} = D(T, \text{excitation conditions}) W_{\nu}^{\text{heat emission}} =$$

$$= D \cdot A_{\nu} u_{\nu} = d \cdot A_{\nu} \nu^3 \frac{1}{e^{h\nu/kT} - 1} \text{ holds. (1) is valid}$$

if during the excited state of the molecules the center
 of emission is in statistical equilibrium with the
 surrounding medium. (1) holds not only for the solutions
 of complicated molecules but also for other condensed

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On the Agreement of the Absorption- and Luminescence - SOV/48-22-9-6/40
Bands of Molecules With Complicated Structure

systems. (1) partly holds also for the vapor of complicated molecules. In this case a rapid redistribution of the oscillation energy according to the various degrees of freedom takes place during the excited state of the molecule; also a stabilization of the statistical equilibrium within every excited molecule takes place. According to (1) the intensity of luminescence is proportional to the intensity of heat emission. Thus from the shape of the absorption band which is known from experiment the shape of the heat emission band can be calculated and compared with the contours of the luminescence band. A check of (1) by means of the available experimental data is very difficult. The first results (Refs 1,5,6) prove the correctness of (1) and give information on deviations of (1). In the work (Ref 1) (1) was employed in the development of a method serving for the determination of the frequency of the purely electron transition. This transition is determined from an absorption band without measurements of the spectrum of luminescence or from a luminescence band without measurements of the absorption

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On the Agreement of the Absorption- and Luminescence-
Bands of Molecules With Complicated Structure

SOV/48-22-9-6/40

spectrum. In an exacting consideration this method is applicable only to those molecules that exhibit a mirror symmetry of the long-wave absorption- and luminescence bands. As the symmetry near the intersections of the spectra in general is maintained the suggested method may be of practical importance. There are 2 figures and 6 references, 6 of which are Soviet.

ASSOCIATION: Institut fiziki i matematiki Akademii nauk BSSR (Institute of Physics and Mathematics, AS Belorusskaya SSR)

Card 3/3

AUTHORS: Stepanov, B. I., Khvashchevskaya, Ya. S., SOV/46-22-9-20/40

TITLE: Spectroscopy of Negative Currents of Radiation Energy
(Spektroskopiya otritsatel'nykh potokov luchistoy energii)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1958,
Vol 22, Nr 9, pp 1089 - 1092 (USSR)

ABSTRACT: If a correct interpretation of experimental data
of infrared spectroscopy or of high-temperature
spectroscopy is desired it is indispensable to take
into account the background heat radiation and primarily
the heat emission of the substance in question, of
the radiation receiver and even of the material of
the cuvette window. Contrary to positive currents the
maximum value of negative currents is limited. Hence
the effect of the negative currents is comparatively
small and often remains unnoticed. The various occurring
in particle systems under the influence of negative
currents are equivalent to usual effects. The negative
current is either absorbed, dispersed or reflected.
Considerations of a purely theoretical nature induced

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Spectroscopy of Negative Currents of Radiation Energy SOV/48-22-9-20/40

the authors to engage in experimental investigations. Even the first experiments showed that the negative currents can easily be recognized. They exhibit the usual properties of positive currents. They can be used for the determination of the energy level, of the absorption coefficients, of the indices of refraction, of the duration of the excited state, of the yield, of the indicatrix of dispersion etc. Noticeable negative currents are obtained in the infrared range. If the cuvette containing the substance is heated to high temperatures, they can even be recorded in the visible range. In the study of the properties of negative currents which propagate from a cold source towards the cuvette the heat emission of the radiation receivers must be taken into account. This emission is also very high and remains unnoticed only because it is compensated in the encounter with the currents emitted by the cuvette or by other outside objects. The experimental results fully justify the use of the concept of negative currents. It permits to interpret correctly numerous experimental

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Spectroscopy of Negative Currents of Radiation Energy SOV/46-22-9-20/40

effects and to extend the range of application of the known formulae of theoretical optics. Recently Veyngerov and his collaborators discovered a negative optic-acoustical effect (Ref 3). This phenomenon fits into the general scheme of the processes investigated. There are 3 figures and 6 references, 6 of which are Soviet.

ASSOCIATION: Belorusskiy gos. universitet, Institut fiziki i matematiki Akademii nauk BSSR (Belorussiya State University, Institute of Physics and Mathematics, AS Belorusskaya SSR)

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24(7)

SOV/48-22-11-19/33

AUTHOR:

Stepanov, B. I.

TITLE:

Relations Between Luminescence Spectra and the Absorption of Complex Molecules (Svyaz' spektrov lyuminestsentsii i pogloshcheniya slozhnykh molekul)

PERIODICAL:

Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol 22, Nr 11, pp 1367-1371 (USSR)

ABSTRACT:

In a previous paper (Ref 1) the author demonstrated that the contours of the fluorescence band of complex molecules w_{ν}^{lum} are related to the contours of the long-wave absorption band α_{ν} by a simple equation

$$w_{\nu}^{\text{lum}} - D w_{\nu}^{\text{thermal emission}} = d\alpha_{\nu} \nu^3 \frac{1}{e^{h\nu/kT} - 1} \approx d\alpha_{\nu} \nu^3 e^{-h\nu/kT} \quad (1)$$

The first check of equation (1) was carried out by Kazachenko (Ref 4). It yielded, however, no unequivocal results. Definite information was obtained by Alentsev (Ref 5), who presented

$$\ln \frac{\alpha_{\nu}}{w_{\nu}^{\text{lum}}} + 3 \ln \nu = \frac{h\nu}{kT} + \text{const} \quad (8)$$

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SOV/48-22-11-19/35

Relations Between Luminescence Spectra and the Absorption of Complex Molecules

to be substituted for (1). Alentsev arrived at the conclusion, that the redistribution of energy between the fluorescent molecule and the molecules of the solvent proceeds comparatively slowly and that the molecules in an excited state transfer only part of their thermal energy to the solvent. The pertaining curves (straights) were plotted by L. G. Pikulik (Fig 2) and L. A. Kravtsov (Fig 3). The T^* value determined from the slopes of these curves is dependent upon the kind of molecule and of the solvent. If $T^* \gg T$ Alentsev suggested a more general formula

$$w_{lum}(T) = dU_v(T^*) e^{-h\nu/kT} \quad (9)$$

replacing (1). The inequality $T^* \neq T$, which was found to apply in some experimental cases, does not mean that (1) is erroneous. It means rather that certain conditions were not satisfied. This places (1) in a position of a criterion in the determination of the equilibrium distribution with respect to the levels of excited molecules. The differences $T^* - T$ are a measure of the interaction with the solvent and of the transfer rate of the excess energy. The alternative whether relation (9) or (1) applies to vapors of fluorescent substances requires a separate

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NOV/48-22-11-19/44

Relation between luminescence spectra and the absorption of Complex Molecules

the reaction. The inequality $\nu^* > \nu$ must contain a number of consequences, which demand a special experimental check. The dependence of the luminescence spectrum of solutions upon the frequency of the exciting light was determined in the anti-
 -taken place, where $\nu_{exc} < \nu_{lum}$. (Fig. 1). (Fig. 2). (Fig. 3).
 1 table, and 8 references. (which are listed).

LOCATION: Institut fiziki i matematik Akademii nauk BSSR (Institute of Physics and Mathematics, AS Belorussian R)

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SOV/48-22-11-23/33

24(7)

AUTHOR:

~~Stepanov, B. I.~~, Apanasevich, P. A.

TITLE:

On the Concepts of Photoluminescence and Dispersion (O ponyatiyakh fotolyuminestsentsii i rasseyaniya)

PERIODICAL:

Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol 22, Nr 11, pp 1380-1386 (USSR)

ABSTRACT:

The distinction between luminescence and dispersion is at present drawn by applying the criterion of duration as advanced by S. I. Vavilov. The application of this criterion provided a means of explaining the nature of the Vavilov-Cherenkov effect and of the so-called blue glow. In some cases the application of this criterion meets with considerable difficulties. This is true in particular for the classification of resonance emission, which is found in atoms and in simple molecules. This phenomenon is in some quarters termed resonance fluorescence, in others resonance dispersion. For this reason this paper presents a detailed theoretical investigation of the light transformation process. The properties of secondary luminescence observed in the course of experiments must be closely connected with the nature of the light transformation process. The difference between dis-

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On the Concepts of Photoluminescence and Dispersion

SOV/48-22-11-23/33

persion and photoluminescence must reflect the differences in the interaction mechanism between the substance and the exciting light. If it is assumed that the classic theory of forced emission of the dipole gives a correct picture of the fundamental properties of dispersion and of resonance emission of light, then there is no way of applying the criterion of duration (extinction) for a classification of secondary luminescence. As it is known the forced emission is firstly extinguished and secondly it is accompanied by a persistent afterglow. Quantum-electrodynamics considerations lead to the same result. Apart from the Rayleigh (releyevskoye) diffusion and resonance luminescence, it also provides a means for investigating other varieties of secondary luminescence and hence for solving the problem of classification. From the viewpoint of quantum-electrodynamics the secondary luminescence can be divided into two parts, which are due to a different mechanism and which exhibit different properties. One part is constituted by the luminescence which is generated under a participation of the intermediate transitions. The other part is represented by luminescence generated without intermediate transitions. A quantum-electrodynamical solution of the problem of light transformation permits to offer

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On the Concepts of Photoluminescence and Dispersion SOV/48-22-11-23/33

a theoretical substantiation of the criterion of extinction and to draw the bounds of its applicability. There are 4 figures and 1 reference, 1 of which is Soviet.

ASSOCIATION: Institut fiziki i matematiki Akademii nauk BSSR (Institute of Physics and Mathematics, AS Belorussian SSR)

Card 3/3

STEPANOV, B.I.

Spectrum analysis. Uch. zap. BGU no.41:9-18 '58. (MIRA 12:3)
(Spectrum analysis)

STEPANOV, B.I.; KHVASHCHEVSKAYA, Ya.S.

Absorption of negative radiation flux. Uch. zap. BGU no.41:19-26
'58. (MIRA 12:3)
(Spectrum analysis) (Radiation)

24(4)

AUTHORS:

SOV/20-121-3-14/47
~~Stepanov, B. I.~~, Member, Academy of Sciences, Belorusskaya SSR,
Gribkovskiy, V. P.

TITLE:

Absorption and Luminescence of a Harmonic Oscillator
(Pogloshcheniye i lyuminestsentsiya garmonicheskogo
ostsillyatora)

PERIODICAL:

Doklady Akademii nauk SSSR, 1958, Vol 121, Nr 3, pp 446-449
(USSR)

ABSTRACT:

This paper discusses the quantum-mechanical calculation of the power of absorption and luminescence of a linear harmonic oscillator. According to the results of these calculations, all the conclusions of the classical theory concerning the integral absorption and the luminescence of the harmonic oscillator coincide with the results of the classical theory. For these calculations the authors used the quantum-mechanical probabilities of the transitions between the various energy levels. Also the Einstein (Eynshteyn) relation between the probabilities of the spontaneous and induced transitions is used. The authors then investigate the assemblage of the harmonic oscillators which interact with external interaction. Moreover, the oscillators

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Absorption and Luminescence of a Harmonic Oscillator SOV/20-121-3-14/47

are assumed to be located in a thermal radiation field. The background of the thermal emission is of essential importance, especially in the infrared part of the spectrum. A system of differential equations is given for the distribution of the oscillators with respect to the energy levels. The induced emission is considered to be a negative absorption. The absorption power of the harmonic oscillator does not depend on the distribution function and on the background of the thermal emission and, therefore, on the temperature of the surrounding medium. The linear dependence of the absorption power on the density of the exciting light is an argument in favor of the validity of the Buzer law. The formula for absorption power does not contain the Planck (Planck) constant h and the elasticity coefficient k of the oscillator. In the classical theory, the absorption power of N harmonic oscillators is given by the same expression. However, the absorption coefficient of a system of particles with 2 levels (or of any other system with non-equidistant energy levels or with a finite number of levels) depends on the density of the exciting light and also on the temperature. In this respect, there is a clear difference from the conclusions of classical electrodynamics. An expression is then given for the luminescence power of N harmonic oscillators

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Absorption and Luminescence of a Harmonic Oscillator SOV/20-121-3-14/47

which takes into account the background of thermal emission. Another expression characterizes the extinction law (zakon razgoraniya) of luminescence, and from this expression the value of the luminescence power for a steady irradiation is deduced. In this case the luminescence power is equal to the absorption power and it coincides exactly with the corresponding value of the classical theory. Also the expression for the damping of the luminescence is identical with the classical damping law of the luminescence of a harmonic oscillator. Therefore, the final conclusions of the classical theory and of the quantum theory concerning the integral absorption and emission of a harmonic oscillator do not only correspond to one another, but they fully coincide. For sufficiently low temperatures and for the usual intensities of the incident radiation, the overwhelming majority of the oscillators is not excited, and therefore only the first pair of the levels is of essential importance. There are 8 references, 8 of which are Soviet.

ASSOCIATION: Institut fiziki i matematiki Akademii nauk BSSR (Institute of Physics and Mathematics, AS BSSR)

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SOV/30-59-1-9/57

24(7),24(0)
AUTHOR:

Stepanov, B. I., Academician AS
Belorusskaya SSR

TITLE:

Investigations by Belorussian Scientists in the Field of
Spectroscopy and Luminescence (Raboty belorusskikh uchenykh
po spektroskopii i lyuminesentsii)

PERIODICAL:

Vestnik Akademii nauk SSSR, 1959, Nr 1, pp 68-76 (USSR)

ABSTRACT:

These investigations are being carried out at the Institut
fiziki i matematiki (Institute of Physics and Mathematics)
and the fizicheskii fakul'tet Belorusskogo universiteta
(Physica Department, Belorussian University) under the direct-
ion of B. I. Stepanov, A. N. Sevchenko, M. A. Yel'yashevich,
Academicians AS BSSR, and F. I. Fedorov, Corresponding Member,
Academy of Sciences, BSSR. In the field of theoretical spectro-
scopy, the investigations by P. A. Apanasevich, B. I. Stepanov
are mentioned. Further, the following in-
vestigations are indicated:
V. P. Gribkovskiy - systematic comparison of classical and
quantum-electrodynamical calculation results of optical
properties of various systems.
The author of this article, in common with collaborators of

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Investigations by Belorussian Scientists in the Field of Spectroscopy and Luminescence SOV/30-59-1-9/57

the Fizicheskii institut im. P. N. Lebedeva (Physics Institute imeni P. N. Lebedev) determined the dependence of luminescence on the surrounding temperature, which contributed to clarification of the character of anti-Stokes fluorescence. B. I. Stepanov, Ya. S. Khvashchinskaya used the general principles of spectroscopy of negative currents in their examinations.

On the basis of experimental data A. M. Samson obtained important results in the determination of genuine values of optical characteristics of the substance examined. L. A. Kravtsov, N. P. Ivanov examined calculation methods of reabsorption with large overlapping of absorption and luminescence spectra.

N. A. Borisevich succeeded in obtaining fundamental results in the examination of luminescence of phthalimide vapors. He also showed that the efficiency of quenching collisions may be much less than one.

L. G. Pikulik, under the direction of A. N. Sevchenko, examines the influence of the solvent on the yield of fluorescence as well as the absorption and emission spectra.

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A. N. Sevchenko, G. P. Gurinovich, A. M. Sarzhevskiy examined the luminescence polarization of many combined molecules. At the same time they designed an improved apparatus.

A. N. Sevchenko, V. V. Kuznetsova work in the field of luminescence of rare-earths complexes.

V. A. Pilipovich examined the phenomenon of phosphorescence. The examinations of optical properties of chlorophyll and related compounds are being carried out in close cooperation with the Institut biologii Akademii nauk BSSR (Institute of Biology, Academy of Sciences, Belorusskaya SSR).

T. N. Godnev, L. A. Kravtsov, R. V. Yefremova examined the absorption and luminescence spectra of a live leaf.

A. N. Sevchenko, G. P. Gurinovich, K. N. Solov'yev, L. A. Kravtsov examined polarization spectra and the dependence of polarization on the wave length of fluorescence.

A. N. Sevchenko, L. V. Volod'ko obtained valuable data of the composition of complex compounds and the nature of intermolecular forces of interaction.

I. P. Shapiro examined the optical and electrical properties of some crystal phosphors.

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Investigations by Belorussian Scientists in the Field SOV/30-59-1-9/57
of Spectroscopy and Luminescence

A. N. Sevchenko, B. I. Stepanov examined cellulose and its products of transformation.

R. G. Zhbakov, I. N. Yermolenko worked at high pressure in order to study the composition of celluloses by means of spectroscopical methods.

I. N. Yermolenko, R. G. Zhbakov examined the oxidizing kinetics of cellulose by means of nitrogen dioxide, iodic acid and chloride.

R. G. Zhbakov, B. I. Stepanov, A. Ya. Rozenberg, A. I. Skrygan, A. M. Shishko examined the mercerizing process of cellulose.

M. M. Pavlyuchenko, I. N. Yermolenko examined the oxidation of celluloses with the use of absorption spectroscopy in the ultraviolet range.

M. M. Pavlyuchenko and collaborators spectrophotometrically examined the adsorption of coloring substances on cellulose.

I. N. Yermolenko, M. Z. Gavrilov examined the luminescence of cellulose products.

B. I. Stepanov, Yu. I. Chekalinskaya determined the dependence of the spectra of dispersed objects on the reduction

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Investigations by Belorussian Scientists in the Field of Spectroscopy and Luminescence SOV/30-59-1-9/57

ratio, the character of the binding agent, and the layer thickness.

A. P. Prishivalko, B. I. Stepanov developed a theory of dispersion light filters.

N. A. Borisevich, Ya. S. Khvashchevskaya, I. P. Laptsevich examined, by experiment, dispersion light filters for the infrared range.

A. P. Prishivalko analysed the accuracy and the field of application of existing determination methods of optical constants of dispersed and not dispersed materials.

I. G. Nekrashevich, A. A. Labuda, Ye. G. Martynkov obtained important results concerning the kinetics of one single spark discharge (spectral intensity and discharge temperature).

A. A. Yankovskiy, V. S. Burakov examined the mutual influences of elements in spectrum analysis, and explained the methods for their elimination.

G. V. Ovechkin suggested a series of methods to eliminate the influences of third elements.

G. V. Ovechkin, N. P. Krivosheev succeeded in working out a control method of benzyl penicillin in ordinary penicillin.

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Investigations by Belorussian Scientists in the Field SOV/30-59-1-9/57
of Spectroscopy and Luminescence

N. A. Borisevich, N. I. Makarevich, A. I. Skrygan examined the infrared spectra of resinous products.
N. A. Borisevich, V. I. Pansevich, I. F. Gurinovich examined a series of structural peculiarities of alcohol oxides.
N. A. Borisevich worked out a luminescence method for the determination of the germinating power of the seed of some kinds of trees.
A. Ya. Prokopchuk obtained good results by the use of luminescence analysis in dermatology.
S. S. Kharamonenko examined the absorption spectra of the albuminous polysaccharide complexes.
D. A. Markov used spectral methods for analyzing albuminous fractions in the blood.
M. M. Pavlyuchenko, G. A. Lazerko, carried out an extensive spectrophotometrical examination of the formation of molecular and complex compounds in solutions.
N. A. Sevchenko spectroscopically examined the structure of various silicas.
B. I. Stepanov, A. M. Prim carried out theoretical investigations of the vibrational spectra of various silicate crystals

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Investigations by Belorussian Scientists in the Field of Spectroscopy and Luminescence SOV/30-59-1-9/57

and silicate glasses. Some branches of research are only at the beginning of their development such as radiospectroscopy (M. A. Yel'yashevich), and nuclear spectroscopy (A. A. Bashilov). Especially mentioned are also the investigations by F. I. Fedorov on new invariant methods of solution of basic equations in classical electrodynamics. The author stated that the research work is being carried out in close cooperation with scientists in Moscow, Leningrad, Kiyev, Tartu, Saratov, and other towns in the Soviet Union. The coordination of work is done by the Komissiya po spektroskopii Akademii nauk SSSR (Commission of Spectroscopy, Academy of Sciences, USSR) (S. L. Mandel'shtam) and the nauchnyy sovet po probleme "Lyuminestsentsiya i yeye primeneniya" (Scientific Council for the Problem of "Luminescence and Its Use") (V. L. Levshin). The 8th Conference on Luminescence will take place in Minsk in 1959. A zone conference on spectroscopy is to take place in the Belorusskaya SSR in 1960, with scientists from Ukraine, Lithuania, Latvia, and Esthonia participating. All work on spectroscopy in the republic is coordinated by the Institute of Physics and

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STEPANOV, B.I., [Stsiapanau, B.I.]

Some problems in theoretical spectroscopy. Vestsi AN BSSR. Ser. fiz.-
tekh. nav. no.3:5-15 '59. (MIRA 13:3)

1. AN BSSR.

(Spectroscopy)

84111

S/058/60/000/007/013/014
A005/A001

6.4780

Translation from: Referativnyy zhurnal, Fizika, 1960, No. 7, p. 378, # 18318

AUTHORS: Gribkovskiy, V. P., Apanasevich, P. A., Stepanov, B. I.

TITLE: The Optical Properties of the Harmonic Oscillator

PERIODICAL: Tr. In-ta fiz. i matem. AN BSSR, 1959, No. 3, pp. 131-141

TEXT: The authors study by the quantum-mechanical method the absorption and emission of light by a linear harmonic oscillator. It is shown that all conclusions of the classic theory which deal with the integral absorption and emission of a harmonic oscillator, agree with the conclusions drawn according to the quantum theory. It is noted that the absorption and emission of the oscillator differ from the absorption and emission of a system having two levels. This difference becomes more essential when non-optical transitions exist. In spite of this difference, the energy yield of the system with two levels coincides with the yield of the oscillator. X

ASSOCIATION: In-t fiz. i matem. AN BSSR (Institute of Physics and Mathematics of AS BSSR)
K. S. Vul'fson

Translator's note: This is the full translation of the original Russian abstract.

Card 1/1

STEPANOV, B.I.

Principal problems in present-day spectroscopy. Trudy Inst.
fiz.i mat.AN BSSR no.3:9-37 '59. (MIRA 13:4)
(Spectrum analysis)

KAZACHENKO, L.P.; STEPANOV, B.I.

Contour of absorption and luminescence bands of complex molecules.
Dokl. AN BSSR 3 no.5:190-193 My '59. (MIRA 12:10)
(Spectrum, Molecular)

SOV/170-59-4-8/20

24(1, 4)

AUTHORS:

Stepanov, B.I., Rubanov, A.S.

TITLE:

On the Theory of Negative Optical-Acoustical Effect (K teorii otritsatel'nogo optiko-akusticheskogo yavleniya)

PERIODICAL:

Inzhenerno-fizicheskii zhurnal, 1959, Nr 4, pp 52-62 (USSR)

ABSTRACT:

A new phenomenon, the sounding of an optico-acoustical chamber when the source of light is replaced by a cooled body, was described and correctly explained by Veyngerov, Gerlovin and Pan-kratov [Ref 1]. Oscillations in gas pressure arise due to the periodic cooling connected with the transformation of the gas kinetic energy into the oscillational energy of molecules and then into radiation. In the present paper a detailed analysis of the main processes taking place in the optico-acoustical chamber is given. A concept of negative radiation fluxes, convenient for the description of the negative optico-acoustical effect, was formulated by Stepanov [Ref 4] and is employed in the present investigation. The negative optico-acoustical effect arises as a result of the negative pulsating illumination of a gas. Processes which take place at that are analogous to the processes arising during the absorption by the gas of a

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On the Theory of Negative Optical-Acoustical Effect

SOV/170-59-4-8/20

modulated flux of positive radiation, but they proceed in the opposite sense. Both the positive and negative optico-acoustical effects are described by the same mathematical relationships. The magnitude of pulsation of temperature resulting from the absorption of a modulated flux is proportional to the density of incident radiation and depends on the temperature of the surrounding medium. All calculations are carried out taking into account the background of thermal radiation. Expressions (30) and (31) in the present paper are converted into the formulae of Reference 5, derived without an allowance for the thermal radiation background, if the temperature of the surrounding medium is assumed to be equal to zero.

ASSOCIATIONS: There are 4 tables, 1 graph and 7 Soviet references. Institut fiziki i matematiki AN BSSR (Institute of Physics and Mathematics of the Belorussian AS). BGU imeni V.I. Lenina (Belorussian State University imeni V.I. Lenin), Minsk

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50V/51-7-4-1/32

AUTHORS: Stepanov, B.I. and Apanasevich, P.A.

TITLE: Classification of Secondary Emission

PERIODICAL: Optika i spektroskopiya, 1959, Vol 7, Nr 4, pp 437-445 (USSR)

ABSTRACT: Propagation of light is accompanied by emission of the medium it traverses. Depending on its properties, this secondary emission is usually divided into photoluminescence (fluorescence and phosphorescence) and forced emission (Raylight and Raman scattering, reflection and so on). This division was suggested by Vavilov (Ref 1) who used duration of emission or the closely related effect of quenching as the criteria of classification of non-equilibrium emission (the non-equilibrium emission is the emission of a body in excess of its thermal radiation). Luminescence was defined by Vavilov as the non-equilibrium emission with afterglow of long duration, subject to quenching. Forced emission was taken to include all emission which disappears practically immediately after the action of an external agent (light). It was assumed that forced emission is not quenched. Vavilov's criteria are not entirely satisfactory; they fail when applied to resonance radiation. The present authors used quantum-electrodynamic approach

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SOV/51-7-4-1/32

Classification of Secondary Emission

to deduce a consistent classification of secondary emission. The division between photoluminescence and scattering was based on the presence or absence of intermediate processes between the acts of generation and annihilation of photons. The limits of applicability of Vavilov's criteria are also discussed. The paper is entirely theoretical. There are 27 references, 16 of which are Soviet, 2 English, 5 German, 2 French and 2 translations.

SUBMITTED: January 24, 1959

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7(3), 5(4), 24(7)

SOV/48-23-10-19/39

AUTHORS:

Stepanov, B. I., Zhabankov, R. G., Yermolenko, I. N.

TITLE:

Infrared Spectra of Cellulose and of Its Derivatives

PERIODICAL:

Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959
Vol 23, Nr 10, pp 1222-1223 (USSR)

ABSTRACT:

It is pointed out in the introduction that cellulose as a fiber could be investigated only inadequately, because light dispersion presents a considerable obstacle in infrared spectroscopic investigations. Attempts made to avoid this obstacle by dissolving the fiber, or by embedding it in an immersion medium, or even by regenerating cellulose to cellophane gave entirely unsatisfactory results which did not show the true cellulose spectrum. Thus, the authors endeavored to press cellulose fibers without any addition, and they investigated the spectrum of these pressed cellulose samples within the range of from 2.5 to 15 μ . In the spectra of native celluloses bands were found in the following ranges: 3330, 2940, 1650, 1428, 1360, 1340, 1325, 1290, 1225, 1190, 1150-910 and 705 cm^{-1} . The former is to be attributed to the OH-valence vibrations. In the spectra of oxidized celluloses an intense

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SOV/48-23-10-19/39

Infrared Spectra of Cellulose and of Its Derivatives

band was found at 1740 cm^{-1} (C=O). An increase of the degree of oxidation attenuated the intensity of the bands 1430 , 1360 , 1340 , and 1325 cm^{-1} and increased the intensity of the band in the range of 1280 - 1160 cm^{-1} . Further details are discussed in this connection. A nitration resulted in the occurrence of the bands 1290 , 1390 , and 1200 cm^{-1} . The spectrum of dialdehyde cellulose was characterized by absorption in the range of 900 cm^{-1} . A cellulose with many carboxyl groups showed a weak band at 955 cm^{-1} , mercerized cellulose showed increased absorption in the range of 910 cm^{-1} , etc. In conclusion, the great importance of cellulose infrared spectroscopy is pointed out.

ASSOCIATION: Institut fiziki i matematiki Akademii nauk BSSR (Institute of Physics and Mathematics of the Academy of Sciences of the Belorussian SSR)

Card 2/2

STEPANOV, B.I., akademik

Work of White Russian scientists in spectroscopy and luminescence.
Vest.AN SSSR 29 no.1:68-76 Ja '59. (MIRA 12:2)

1. AN BSSR.
(Spectrum analysis) (Luminescence)

5(4)

AUTHORS:

SOV/76-33-9-2/37
Stepanov, B. I., Zhbakov, R. G., Rozenberg, A. Ya.

TITLE:

Infrared Spectra of Cellulose in the Viscose-production Process

PERIODICAL:

Zhurnal fizicheskoy khimii, 1959, Vol 33, Nr 9, pp 1907-1913
(USSR)

ABSTRACT:

The infrared spectra (IS) of the sulfite-, alkaline- and hydrate-cellulose were investigated within the wave-range 2.5-13 μ during various stages of the technological process of viscose-production. By applying a special methodology (Ref 3), the investigations (as distinct from others of this type (Ref 2)), could be carried out without an immersion medium. A spectrometer of the type IKS-11, an amplifier of the type FEOU-12 and an optical indicator of the type IZV-1 were used. It was observed that after a treatment of the cellulose (C) with concentrated lye, a considerable reduction in the intensity of the spectral bands of the deformation-oscillations in the CH₂-group takes place, i.e. the mercerized (C) is of different structure than the initial product. The latter is also confirmed by a strong increase of the absorption in the wave-range 910 cm⁻¹. It was established, however, that this cannot

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Infrared Spectra of Cellulose in the Viscose-production Process

be traced to an accumulation of aldehyde groups through oxidation with atmospheric oxygen, or a hydrolysis during the washing out of the lye. A reduction of the intensity of the spectral band of the hydroxyls (3333 cm^{-1}), which was observed in the (S) of dried alkaline-(C) samples, permits the assumption that under the given circumstances, a formation of the cellulose alcoholate is not impossible. Practically all primary hydroxyl groups of the (C) react with the lye already during the mercerizing, so that the penetration of the lye into the basic mass of the (C) can be assumed. The papers by V. N. Nikitin (Ref 1) are mentioned in the text. There are 5 figures and 11 references, 9 of which are Soviet.

ASSOCIATION: Belorusskiy gosudarstvennyy universitet, Minsk (Belorussian State University, Minsk). Zavod iskusstvennogo volokna, Mogilev (Factory for Synthetic Fibres, Mogilev)

SUBMITTED: July 10, 1957

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24(8)
AUTHORS: Stepanov, B. I., Academician of the AS Belorusskaya SSR,
Rubanov, A. S.

TITLE: The Effect of the Background of Thermal Radiation on the Deflection of Radiation Receivers

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 128, Nr 3, pp 517-520 (USSR)

ABSTRACT: M. L. Veyngerov and coworkers (Refs 1-4) discovered a new particular phenomenon, i.e. the sounding of an optical-acoustical chamber occurring due to the substitution of a cooled body for the usual radiation source. Besides, M. L. Veyngerov gave a correct interpretation of this phenomenon. This article deals with the general case and reveals several details required for consequent consideration of the background of thermal radiation. At temperature equilibrium of the radiation receiver with the surrounding medium, the amount of energy absorbed by the receiver is equal to the energy emitted by it. The receiver in principle does not record radiation corresponding to its temperature. Deflections are only possible if the thermodynamic equilibrium is disturbed, i.e. if the temperature of the receiver or medium varies, or addi-

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SOV/20-128-3-23/58

The Effect of the Background of Thermal Radiation on the Deflection of Radiation Receivers

tional radiation sources are introduced. After some intermediate calculations, the authors obtained the following expression for the deflections of the measuring instrument:

$$Y = \gamma \alpha A_{\text{rec}} \left[A_{\text{source}}^{\text{em}} - A_{\text{source}} U(T_{\text{med}}) \right] +$$

$$+ \gamma \alpha A_{\text{rec}} \left[U(T_{\text{med}}) - U(T_{\text{rec}}) \right]$$

where γ denotes a coefficient dependent upon the characteristic features of the receiver, α a constant dependent upon the geometric configuration of the apparatus, A_{rec} and A_{source}

the absorptive power of the receiver and the source, $U(T_{\text{rec}})$ Planck function of the medium temperature. The radiant flux to be measured by the receiver,

$$\alpha \left[S_{\text{source}}^{\text{em}} - A_{\text{source}} U(T_{\text{med}}) \right] + \alpha \left[U(T_{\text{med}}) - U(T_{\text{rec}}) \right]$$

($S_{\text{source}}^{\text{em}}$ denoting the energy flow) is independent of the absorptive power of the receiver, and equals the difference of the two fluxes: 1) of the flux incident upon the receiver after disturbance of the thermodynamic equilibrium, and 2) of the

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SOV/20-128-3-23/58

The Effect of the Background of Thermal Radiation on the Deflection of
Radiation Receivers

flux $\alpha U(T_{\text{rec}})$ incident at $T_{\text{source}} = T_{\text{med}} = T_{\text{rec}}$. The authors then investigated some special cases: a) thermodynamic equilibrium. b) The receiver temperature differs from the medium temperature. There are no additional radiation sources. c) The temperature of the receiver and the medium are equal, but there is a radiation source. The article is concluded with an investigation of the complicated scheme employed for the investigation of the absorptive power. It is composed of a light source, a receiver, and the plane-parallel layer to be investigated. There are 7 Soviet references.

ASSOCIATION: Institut fiziki i matematiki Akademii nauk BSSR
(Institute of Physics and Mathematics of the Academy of
Sciences of the Belorussian SSR)

SUBMITTED: June 29, 1959

Card 3/3

BURAKOV, Viktor Semenovich; YANKOVSKIY, Anton Antonovich; ~~STEPANOV, B.I.~~
akademik, red.; TIMOFEEV, L., red.isd-va; VOLOKHANOVICH, I.,
tekhn.red.

[Practical handbook of spectrum analysis] Prakticheskoe
rukovodstvo po spektral'nomu analizu. Minsk, Isd-vo Akad.nauk
BSSR, 1960. 231 p. (MIRA 14:3)

1. AN BSSR (for Stepanov).
(Spectrum analysis--Handbooks, manuals, etc.)

STEPANOV, Boris Ivanovich, doktor fiziko-matem.nauk, akademik; KARLYUK,
A.S., kand.filosof.nauk, nauchnyy red.; SHEVILAK, V.A., red.;
VOROTYNSKAYA, S.A., tekhred.

[Present-day physics and dialectical materialism] Sovremennaya
fizika i dialekticheskii materializm. Minsk, 1960. 52 p.
(Obshchestvo po rasprostraneniю politicheskikh i nauchnykh znaniy
Belorusskoi SSR, nos. 16/17).

(MIRA 13:12)

1. AN BSSR (for Stepanov).
(Dialectical materialism)

(Physics--Philosophy)

S/058/61/000/011/003/025
A058/A101

24.6800
AUTHOR: Stepanov, B.I.

TITLE: Fundamental principles of negative luminous flux spectroscopy

PERIODICAL: Referativnyy zhurnal. Fizika, no. 11, 1961, 110, abstract 11V88 (V sb. "Molekulyarn. spektroskopiya", L., Leningr. un-t, 1960, 20 - 34)

TEXT: The author subjects the problems of negative luminous flux spectroscopy to a general analysis. He investigates the dependence of the readings of a radiation detector on the background of thermal radiation and on the temperature of the detector and the source. He gives examples of negative flux absorption spectra. He demonstrates the complete equivalence of negative and positive flux as regards absorption and scattering in plane-parallel layers. He examines the negative excitation of a system of particles under the action of radiation fluxes of different sign, and defines the concept of the negative absorption coefficient for a system with two or more energy levels. He enters into a theory of negative luminescence and negative photoeffect. There are 13 references. ✓B

Ye. Aleksandrov

[Abstracter's note: Complete translation]

Card 1/1

058/61/000/003/021/044
A058/A101

9.5300

AUTHORS: Stepanov, B. I., Puharov, A. B.

TITLE: Calculation of the indications of a detector used with optical amplifiers

PERIODICAL: Referativnyi zhurnal, Fizika, no. 8, 1981, 178, abstract 89209
("Dokl. AN BSSR", v. 4, no. 9, 1980, 372-375)

TEXT: A general calculation of the indications of a radiation detector with an optical amplifier placed between the detector and the source is carried out. Equations describing the change in detector indications incident to switching on of the amplifier are derived. The amplification factor of the radiation flux is determined and the method of measuring it is indicated. The quantum yield of the amplifier's emission is considered. There is given a curve of the radiation detector indications as a function of the relative location of the detector and the volume under investigation. The applicability of the given analysis to amplifiers and attenuators of corpuscular streams is pointed out.
Ye. Aleksandrov

[Abstracter's note: Complete translation]

Card 1/1

S/051/60/008/02/007/036
E201/E391
B.I.

AUTHORS: Gribkovskiy, V.P. and Stepanov, B.I.
TITLE: Polarization of Luminescence of a Harmonic Oscillator
PERIODICAL: Optika i spektroskopiya, 1960, Vol 8, Nr 2,
pp 176 - 182 (USSR)

ABSTRACT: The authors showed earlier (Ref 1) that absorption, luminescence and duration of afterglow of a harmonic oscillator, calculated using classical and quantum-mechanical theories, are completely identical. The present paper gives a quantum-mechanical calculation of polarization of luminescence of a system of particles with two energy levels and of an assembly of harmonic oscillators. It is found that polarization of luminescence of a system of two energy levels, usually represented by a classical dipole, is less than polarization of luminescence of harmonic oscillators and depends on the intensity of the exciting radiation and the ambient medium temperature. Particles with two energy levels can be represented by a classical dipole only at low excitation energies and low

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S/051/60/008/02/007/036

E201/E391

Oscillator

Polarization of Luminescence of a Harmonic
temperatures. The paper is entirely theoretical.
There are 1 figure and 6 Soviet references.

SUBMITTED: May 12, 1959



Card 2/2

S/051/60/008/02/014/036

E201/E391
V.P.

AUTHORS:

Stepanov, B.I. and Gribkovskiy, V.P.

TITLE:

Dependence of the Polarization of Luminescence of a System of Particles with Three Energy Levels on the Exciting Light Intensity

PERIODICAL: Optika i spektroskopiya, 1960, Vol 8, Nr 2, pp 224 - 231 (USSR)

ABSTRACT: The authors give a precise calculation of dependence of the polarization of luminescence, the absorption coefficient, the dichroism and the intensity of α -phosphorescence on the intensity of the incident radiation for a system of particles with three energy levels, i.e. for molecules possessing normal, unstable and metastable levels (Figure 1). To calculate the polarization of luminescence the authors used the probability method employed by Sveshnikov (Ref 7) in his study of phosphorescence of organic molecules; thermal radiation background was neglected in the present work. It was found that all the dependences mentioned above are non-linear and are related to accumulation of

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S/051/60/008/02/014/036

E201/E391

Dependence of the Polarization of Luminescence of a System of
Particles with Three Energy Levels on the Exciting Light Intensity

particles at the metastable level. The paper is
entirely theoretical.

There are 2 figures and 11 Soviet references.



SUBMITTED: June 22, 1959

Card 2

81279

S/048/60/024/05/05/009
B006/B017

24.4500
AUTHORS: Gribkovskiy, V. P., Stepanov, B. I.
TITLE: On the Agreement Between the Results of the Classical and Quantum Theories of the Interaction Between Light and an Harmonic Oscillator
PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 5, pp. 529-533
TEXT: The present article is a reproduction of a lecture delivered at the Eighth Conference on Luminescence (Minsk, October 19-24, 1959). The authors publish the results of quantum-mechanical computations of the interaction between light and an harmonic oscillator. In this case the oscillator with its infinite totality of energy levels is regarded as a uniform entirety which makes it possible to solve the problem and to obtain a number of new results. Problems of absorption, luminescence, polarization, and of the shape of the spectral lines are dealt with separately. The results and their comparison with those of previous

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81279

On the Agreement Between the Results of the
Classical and Quantum Theories of the Interac-
tion Between Light and an Harmonic Oscillator

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papers (Refs. 1, 2, 10) show the following: All results of quantum theory referring to the optical properties of the harmonic oscillator are in full agreement with the results of the classical theory for the case of dipole approximation. A system with two energy levels cannot be equated to a classical harmonic oscillator. The optical properties of a system with two energy levels or any number of level pairs of a complex quantum system (one quantum oscillator exclusively) correspond to the optical properties of a classical oscillator only if the occupation of the upper level is small as compared with that of the lower level, and if particles from a lower level reach the second level only due to forced optical transitions. An harmonic quantum oscillator can always be regarded as a uniform entirety since, as has been shown already earlier, single level pairs are never equivalent to a classical oscillator. T. P. Kravets is mentioned. There are 10 references: 9 Soviet and 1 German.

ASSOCIATION: Institut fiziki Akademii nauk BSSR (Physics Institute of
the Academy of Sciences of the BSSR)

Card 2/2

S/048/60/024/05/02/009
B006/B017

AUTHORS: Stepanov, B. I., Samson, A. M.

TITLE: Secondary Processes of Absorption and Emission of Light

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960,
Vol. 24, No. 5, pp. 502-508

TEXT: The present article is a reproduction of a lecture delivered at the Eighth Conference on Luminescence (Minsk, October 19-24, 1959). The authors report on the results of their theoretical investigations of resonance luminescence in matter of finite expansion. In contrast to similar investigations of other scientists, they took into account the influence exercised by secondary absorption and emission on the properties of resonance luminescence. The formulas obtained are to be applied to resonance phenomena under various radiation conditions in objects of different sizes. The investigation of the propagation of resonance radiation in finite volumes is the first step in solving the more general problem - propagation of light in matter with any absorption and emission. The influence exercised by secondary processes on the luminescence

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Secondary Processes of Absorption
and Emission of Light

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characteristics can be estimated without knowing the structural details of emission and absorption bands. First, the distribution of excited particles within a radiating volume is investigated. The formulas obtained are applied to the special case of an infinitely plane parallel layer which is hit by perpendicularly incident light. Equations (3) can be solved by graphical integration. Fig. 1 shows the radiation density distribution within the layer (1 cm thick) for six different values of the absorption coefficient k_0 . If the density of radiation is known, the total luminescence density and the number of excited particles with any γ (light yield of an elementary volume) can be calculated from equation (4). Fig. 2 shows the density distribution of the excited particles in the layer with different k_0 and γ . Already with $\gamma = 0.2$ this distribution differs essentially from that without secondary processes. With $k_0 = 0.4$ and $\gamma = 0.2$ the portion of indirectly excited particles is $\sim 10\%$. At higher parameters, it may be 100% and more. In the following, the radiation distribution within and outside this volume is investigated for the

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Secondary Processes of Absorption
and Emission of Light

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case of "reflected" light (emitted into the semi-space containing the primary source) and "penetrating" light (emitted into the other semi-space) is investigated. Indicatrices of angular distribution are shown in Fig. 3. In the following, also the nonsteady case is investigated, and formulas for determining the light yield are given. Finally, a semi-infinite layer is studied, and some considerations concerning the diffuse light flux are discussed as well as problems of attenuation. Fig. 4 shows the time dependence of light intensity for different γ (attenuation curves). Their slope is reduced with increasing γ . Finally, also the dependence of the duration of luminescence on the layer thickness is investigated (Fig. 5) both for "reflected" and "penetrating" light. Analyses show that secondary absorption and emission play an even more important part under nonsteady conditions. For calculating the intensities one can confine oneself to first- and second-order processes, whereas processes of higher order must also be taken into account when studying the duration of radiation. There are 5 figures, 1 table, and 4 Soviet references.

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Secondary Processes of Absorption
and Emission of Light

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B006/B017

ASSOCIATION: Institut fiziki Akademii nauk BSSR (Physics Institute of
the Academy of Sciences of the BSSR)

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Card 4/4

81280

S/048/60/024/05/06/009
B006/B017

24.3500

AUTHORS: Stepanov, B. I., Gribkovskiy, V. P.
TITLE: Nonlinear Optical Phenomena in a Particle System With Three Energy Levels
PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 5, pp. 534-538

TEXT: The present article is a reproduction of a lecture delivered at the Eighth Conference on Luminescence (Minsk, October 19-24, 1959). In his papers S. I. Vavilov repeatedly studied problems of nonlinear optics, among others a particle system with two energy levels. He demonstrated that at high densities s of the exciting radiation, the particle distribution n is no longer a linear function of s . Nonlinear effects occur not only in absorption, luminescence yield, luminescence polarization, dichroism, but also - as has been demonstrated by Vavilov - in dispersion, birefringence, and rotation of the plane of polarization. Such nonlinear effects are completely lacking in the harmonic oscillator, in systems

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Nonlinear Optical Phenomena in a Particle
System With Three Energy Levels

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with two energy levels they are unimportant, and only in special systems they may be high, above all, in complicated molecules with metastable levels. The existence of phosphorescence indicates that not many particles are on the metastable level, which is a fundamental condition for the occurrence of nonlinear effects. The authors now give a simultaneous calculation of the dependence of absorption, luminescence, luminescence polarization of dichroism, and of the alpha-phosphorescence intensity on the intensity of the incident radiation for particles with three energy levels the second of which is metastable and the third is higher and unstable. The calculations were made by the probability method, without taking into account the thermal background ($T = 0$). It is further assumed that the incident radiation is linearly polarized. The intramolecular transitions depend on s and the angle of incidence of primary radiation. Of all optical properties only the final results are presented. At small s , the absorption coefficient is constant. Then, decreases and tends toward zero. Luminescence polarization is $1/2$ at small s , and with $s \rightarrow \infty$ it tends toward zero. At small s the dichroism is proportional to s , with $s \rightarrow \infty$ it attains saturation ($D \rightarrow 1$). With $s = 0$ no alpha phosphorescence occurs; at small s S_{phosph} increases linearly; then, it approaches a

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S/053/60/071/01/04/011
B006/B011

AUTHORS: Borisevich, N. A., Yel'yashevich, M. A., Stepanov, B. I.

TITLE: Eighth All-Union Conference on Luminescence ✓

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol. 71, No. 1, pp. 131-136

TEXT: This Conference was held at Minsk from October 19 to 24, 1959. It had been convened by the Nauchnyy sovet po lyuminestsentsii AN SSSR (Scientific Council for Luminescence) of the AS USSR jointly with the Institut fiziki AN BSSR (Institute of Physics of the AS BSSR) and the Belorusskiy gosudarstvennyy universitet (Belorussian State University). The Conference was attended by 300 delegates, among them 200 from Moscow, Leningrad, Kiyev, Sverdlovsk, Yerevan, Tartu, Poltava, Saratov, Chita, and other centers of the Soviet Union. More than 100 lectures were delivered. Lecturers were A. N. Terenin and V. L. Yermolayev, Leningrad, (intra-molecular energy transfer); V. L. Yermolayev, I. P. Kotlyar, and K. K. Svyatashev (internal conversion from the fluorescence singlet level on the phosphorescence triplet level in naphthalene derivatives); A. N. Terenin and A. V. Shabl' (discovery of phototransport of proton); L. G. ✓

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Pikulik, Minsk (temperature dependence of electron spectra of complex molecules in solution); L. G. Pikulik and A. N. Sevchenko (temperature dependence of quantum yield of fluorescence of phthalimides in high-boiling solvents; V. V. Zelinskiy, V. A. Borgman, I. A. Zhmyreva, V. P. Kolobkov, and I. I. Reznikova, Leningrad (luminescence characteristics of complex molecules); V. V. Zelinskiy, I. A. Zhmyreva, V. P. Kolobkov, A. S. Kotemirovskiy, and I. I. Reznikova (influence of solvents on the spectra of complex organic molecules); N. G. Bakhshiyev (Leningrad) spoke on the same subject. Further lectures were delivered by Ye. I. Bozhevol'nov, Moscow (investigation of fluorescence properties of organic molecules); B. Ya. Sveshnikov and P. I. Kudryashov, Leningrad (concentration depolarization of the fluorescence of solvents); G. P. Gurinovich, A. M. Sarzhevskiy, and A. N. Sevchenko, Minsk (investigation of the extreme polarization degree of the luminescence of complicated molecules in methyl methacrylate); B. A. Zadorozhnyy and Yu. V. Naboykin, Moscow (investigation of the luminescence of over 20 systems with intramolecular hydrogen bonds); again these authors with B. G. Distanov, L. A. Ogurtsova, L. M. Podgornaya, and V. I. Tishchenko (investigation of the luminescence of pyrazoline derivatives); L. D. Derkacheva, Moscow (change

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in the fluorescence of naphthalene in dependence on the concentration of hydrogen ions); L. V. Levshin and V. A. Bocharova, Moscow (investigation of concentration effects in solutions of different organic compounds); G. M. Kislyak, Poltava (phosphorescence of certain solvents and their influence on the absorption spectra of organic phosphors); L. V. Volod'ko, A. N. Sevchenko, and D. S. Umreyko, Minsk (luminescence of uranyl compounds); T. I. Kobyshev, Leningrad (properties of luminescent uranyl ions in the adsorbed state); P. A. Apanasevich, Minsk (quantum electrodynamic method of computing the light absorption and -emission by matter); P. A. Apanasevich and G. S. Kruglik, Minsk (angular distribution of resonance luminosity of vapors); V. P. Gribkovskiy and B. I. Stepanov, Minsk (classical and quantum-theoretical methods of calculating optical properties of a harmonic oscillator); B. I. Stepanov and A. M. Samson, Minsk (influence of secondary processes of light absorption and -emission on the characteristic of resonance luminosity); A. M. Samson, Minsk (method of calculating secondary effects in the luminescence of matter); V. M. Agranovich and Yu. V. Konobeyev, Moscow (reabsorption of light in crystals); S. I. Kubarev, Moscow (mathematical treatment of spectroscopic problems); K. K. Rebane and O. I. Sil'd, Tartu (computation of the probabilities of

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vibrational electron transitions of an oscillator in different approximations); Yu. A. Kurskiy and A. S. Selivanenko, Moscow (phenomenological theory of extinction); M. A. Yel'yashevich, Minsk (interaction of electron motion with vibrations in complex molecules); L. P. Kazachenko, Minsk (calculation of absorption- and luminescence band forms of complex molecules without mirror symmetry); M. N. Alentsev and L. A. Pakhomychева, Moscow (experimental verification of the universal relation between the spectra of luminescence and the absorption of complex molecules by B. I. Stepanov); B. S. Neporent and S. O. Mirumyanets, Leningrad (luminescence of vapors of complex molecules); N. A. Borisevich and V. A. Tolkachev, Minsk (temperature dependence of fluorescence yield of vapors of complex molecules); V. P. Klochkov, Leningrad (interaction between aromatic molecules in vapors); N. A. Borisevich and V. V. Gruzinskiy, Minsk (systematic investigation of electron spectra of fluorescent vapors and anthraquinone solutions); E. V. Shpol'skiy, Moscow, jointly with L. A. Klimova (spectroscopic investigation of aromatic hydrocarbons - Shpol'skiy effect); R. I. Personov (absorption- and fluorescence spectra of perylene); A. Ya. Khesina (spectra of perylene derivatives); D. N. Shigorin, R. N. Nurmukhametov, N. S. Dokunikhin,

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and N. A. Shcheglova, Moscow (investigation of luminescence spectra of halogen derivatives of anthraquinone in dependence on the molecular structure); S. G. Bogomolov, R. F. Pemova, and L. P. Kolosova, Sverdlovsk (semiquantitative determination of 3,4-benzpyrene with the Shpol'skiy effect); M. T. Shpak and Ye. F. Sheka (investigation of luminescence of crystalline naphthalene); A. V. Solov'yev (influence of additional impurities on the absorption- and luminescence spectra in molecular crystals); V. L. Broude and V. S. Medvedev (luminescence of anthracene in different solvents); A. N. Faydysh (luminescence and photoconductivity of anthracene crystals in dependence on the excitation conditions); V. I. Gribkov and D. N. Zhevandrov, Moscow (investigation of the sudden polarization change, caused by the introduction of free excitons, at the shortwave edge of the luminescence spectrum in molecular crystals); V. M. Agranovich, Moscow (theory of exciton luminescence); Ch. B. Lushik, N. Ye. Lushik, and K. K. Shvarts, Tartu (investigation of electron vibration processes in solid solutions of mercury-like ions); Ya. Ya. Kirs and A. I. Laysaar, Tartu (influence of high pressures on the spectral characteristics of luminescence spectra of some solid solutions); M. U. Belyy and B. F. Rud'ko, Kiyev (temperature dependence of luminescence- and absorption

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S/053/6C/071/01/04/011
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spectra of different frozen solutions); Ye. V. Anufriyeva and A. D. Zaytseva, Leningrad (relationship between the vitrification of polymers and their phosphorescence properties); L. T. Kantardzhyan, E. V. Grigoryan, and S. S. Chikinyan, Yerevan (investigation of different ion forms of uranin and fluorescein at different pH of solution); L. T. Kantardzhyan and V. S. Adamov (an attempt of explaining the nonexponential extinction law of phosphorescence in the presence of secondary effects); Sh. D. Khan-Magometova, N. D. Zhevandrov, and V. I. Gribkov, Moscow (investigation of the intensity drop of photoluminescence after irradiation of mixed anthracene and naphthacene crystals); Z. A. Chizhikova, Moscow (experimental determination of the energy yield of radioluminescence of organic substances under the action of γ -radiation); I. M. Rozman, Dobrokhotova and V. V. Uglanova, Moscow (scintillation properties and fluorescence spectra of naphthalene-, stilbene, diphenyl- and other single crystals with impurities); T. N. Godnev, R. V. Yefremova, N. P. Ivanov, and L. A. Kravtsov, Minsk (investigation of chlorophyll formation in leaves); A. A. Krasnovskiy and F. F. Litvin, Moscow (investigation of chemoluminescence spectra of chlorophyll and fluorescence spectra and

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afterglow of leaves); G. P. Gurinovich, A. N. Sevchenko, and K. N. Solov'yev, Minsk (investigation of the polarization of fluorescence of porphyrins and phthalcyanides); V. A. Fedorov and S. I. Freyvert, Leningrad (on a two-beam photoelectric fluorimeter for the quantitative determination of uranium; type: LYUF-57); K. P. Stolyarov and N. N. Grigor'yev, Leningrad (method for the qualitative microchemical analysis with identification of the ions after their formation of chemical compounds); D. P. Shcherbov, R. N. Korzheva, and A. I. Ponomarenko, Alma-Ata (investigation of the fluorescence reaction of boron with benzoyl, method of boron determination); D. P. Shcherbov and R. N. Korzheva, Alma-Ata (fluorescence excitation and problems of fluorometry); T. V. Gurkina and A. V. Drobachenko, Alma-Ata (boron determination with a sensitive fluorometer - limit: 0.06 $\mu\text{g/ml}$); Ye. A. Bozhevol'nov and G. V. Serebryakova, Moscow (investigations with the "Lyumomagnezon IRYeA"); Ye. A. Bozhevol'nov and V. M. Yanishevskaya (luminescence method of aluminum determination); V. K. Matveyev, Moscow (industrial synthesis of a red-glowing luminophosphor); V. V. Patrikeyev and V. K. Matveyev, Moscow (a new method of marking sand with luminophores); N. S. Borodin, Ye. A. Galashin, N. Ya. Semyakina, and V. N. Silayeva, Moscow (phosphorescence of

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distribution zones of colorless substances on chromatographic paper at low temperatures); I. N. Yermolenko, M. Z. Gavrilov, and L. F. Gladchenko, Minsk (relationship between the luminescence intensity of cellulose and the quantity of adsorbed water); V. N. Alekseyev (luminescence-bitumen investigations); M. M. Yudilevich, Rostov-Don (semiautomatic instrument in determinations by luminescence); A. N. Faydysh, L. Ye. Chechik, A. D. Chugay, and M. I. Przhebyl'skiy, Kiyev (control of rubber quality by means of the luminescence method); M. L. Berman, Tashkent (investigation of liquid diffusion in rubber with the luminescence method); V. N. Provorov and V. D. Zaytseva, Moscow (investigation of luminescence properties of rubber and its ingredients in the production on caoutchouc basis); Ye. M. Brumberg, M. N. Meysel', and A. V. Gutkina, Leningrad, Moscow (investigation by luminescence of cells of living organs); V. Kh. Anestiadi, Kishinev (luminescence-microscopic analysis of earcinoma); M. N. Meysel' and L. V. Mirol'yubova, Leningrad (luminescence-microscopic investigation of the structure of bacterial cells); A. P. Kononenko and K. N. Ishchenko-Linnik, Khar'kov (luminescence-microscopic investigation of bacteria); Yu. I. Rubinshteyn, Moscow (luminescence-microscopic investigation of the morphology and structure of some microscopic fungi); ✓

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B006/B011

S. M. Klimenko and N. B. Azadova, Moscow (investigation of the distribution of the antigen of flue virus in a tissue culture by means of fluorescent antibodies at different stages of infection); F. M. Kirillova, Moscow (discovery of the polio virus in tissue cultures by the method of fluorescent antibodies); Ye. A. Kabanova and Ye. N. Levina (luminescence-serological methods of detecting pathogenous microorganisms); T. A. Kalitina, Moscow (production of a fluorescent antitubulinic serum and identification of the serum of microbes Cl. botulinum by its aid); V. A. Blagoveshchenskiy and A. I. Glubokina (production of antisera marked with luminescent dyes); S. N. Braynes, S. V. Konev, and G. P. Golubeva (investigation of the spectra of excitation of ultraviolet fluorescence of blood plasma in man and animals); Sh. D. Khan-Magometova, A. V. Gutkina, and M. N. Meysel, Moscow (UV-fluorescence spectra of animal tissue, and action exerted by X-radiation on it); S. I. Vasilov and V. I. Nikolayev, Chita (determination of the concentration of cordial glucosides in aqueous solutions by means of the luminescence method); Yu. A. Vladimirov, Moscow (systematic study of luminescence spectra, of afterglow spectra, and afterglow excitation spectra of aromatic amino acids and proteins); S. V. Konev and I. I. Kozulin, Moscow (quantitative

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B006/B011

protein determination in milk by comparing the protein fluorescence intensity in the milk with the fluorescence of standards); V. V. Gruzinskiy, G. I. Margaylik, and A. V. Yermolovich, Minsk (determination of the vitality of the seeds of tree species by the luminescence method.

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67898

5.3700(A)

5(4)

AUTHORS:

Piskunov, A. K., Shigorin, D. N.,
Smirnova, V. I., Stepanov, B. I.

S/020/60/130/06/029/059
B004/B007

TITLE:

The Electron Paramagnetic Resonance Spectra of Some Chelate
Compounds of Copper

PERIODICAL:

Doklady Akademii nauk SSSR, 1960, Vol 130, Nr 6, pp 1284 - 1287
(USSR)

ABSTRACT:

The authors investigated the e.p.r. spectra of the chelate compounds of copper with various azo-compounds as well as with the enol-form of acetylacetone and acetoacetic ester. Measurement of the magnetic moments showed that copper forms the compound with two valence electrons. If the initial state of the Cu-atom is d^9sp , it must have an unpaired electron. As, e.g., copper forms four equivalent bonds with acetylacetonate, it is presumed to enter into direct interaction with the π -electrons of the entire system. An investigation was carried out with the purpose of finding out whether the unpaired electron of the metal remains localized on the Cu-atom or whether it is delocalized in the molecule. Table 1 gives the experimental data of the compounds investigated: The width ΔH of the line

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The Electron Paramagnetic Resonance Spectra of
Some Chelate Compounds of Copper

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for 9370 mc, the g-factors, and the magnetic moments. In the acetylacetonate of Cu ΔH decreases considerably when substituents (O-C-CR or Cl) are introduced. In the azo-compounds of copper, which are still richer in π -electrons, ΔH becomes still more contracted. Substitution by chlorine also causes contraction. The increase in π -electrons is found to lead to a contraction of the absorption line. Here, chlorine in ortho position exerts the strongest influence. The authors arrive at the conclusion that the unpaired electron enters into interaction with the π -electrons of the azo group, and by way of this group indirectly with the π -electrons of the entire system. This interaction was confirmed by analysis of the e.p.r. spectra of the compounds dissolved in benzene, chloroform, or dioxane (Fig 1). Their intensity depends on the nature and structure of the complex group. There are 1 figure, 1 table, and 5 references, 2 of which are Soviet. ✓

ASSOCIATION: Nauchno-issledovatel'skiy fiziko-khimicheskiy institut im.
L. Ya. Karpova (Scientific Research Institute of Physical
Card 2/3 Chemistry imeni L. Ya. Karpov). Moskovskiy khimiko-tekhnolo-

67898

The Electron Paramagnetic Resonance Spectra of
Some Chelate Compounds of Copper

S/020/60/130/06/029/059
B004/B007

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(STEPANOV, E.I., akad.; DOLBET, A.I.; SHISHKO, A.M.; SHIRANKOV, R.G.

Bonding between cellulose and substances associated with it in plant tissue. Dokl. Ak. Nauk BSSR no.3:624-626 N '60. (MIRA 13:12)

1. Institut fiziki Akademii nauk BSSR i Institut fiziko-organicheskoy Khimii Akademii nauk BSSR. 2. Akademiya nauk BSSR (for Stepanov).
(Cellulose)

STEPANOV, Boris Ivanovich; YEL'YASHEVICH, M.A., otv. red.; NAYDOVICH,
A.N., red.; BELEN'KAYA, I.Ye., tekhn. red.

[Fundamentals of the spectroscopy of negative luminous fluxes]
Osnovy spektroskopii otritsatel'nykh svetovykh potokov. Minsk,
Izd-vo Belgosuniv. im. V.I.Lenina, 1961. 122 p. (MIRA 15:1)
(Spectrum analysis)

STEPANOV, B.I.; ZHBANKOV, R.G.; MARUPOV, R.

Structure of cellulose hydrate. Vysokom.soed. 3 no.11:1633-1640
N '61. (MIRA 14:11)

1. Institut fiziki AN SSSR.
(Cellulose)

11007

S/058/62/000/009/036/069
A006/A101

AUTHORS: Khapalyuk, A. P., Stepanov, B. I.

TITLE: Conditions of generating radiations by a plane-parallel layer

PERIODICAL: Referativnyy zhurnal, Fizika, no. 9, 1962, 7, abstract 9Zh43
("Izv. AN BSSR, Ser. fiz.-tekhn. n.", 1961, no. 4, 132 - 133)

TEXT: The authors present and analyze formulae for the coefficient of transmission and reflection of electromagnetic waves by a plane-parallel layer with a negative absorption coefficient in a homogeneous medium and in two dissimilar media. For the case of a homogeneous surrounding medium the conditions of wave generation are as follows:

$$r = \exp \frac{4\pi\chi l}{\lambda}, \frac{2\pi\nu}{c} n l - \arctg \frac{2n_{med}\chi}{n_{med}^2 - n^2 - \chi^2} = \pi s,$$

where r is the Fresnel reflection coefficient on the "layer-medium" boundary; n and χ are the real and imaginary parts of the complex refractory index of the plate; n_{med} is the index of medium refraction, λ and ν are the wavelength and Card 1/2

Conditions of generating radiations by...

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A006/A101

light frequency; s is an integral number. The authors note the sensitivity of the generation conditions in respect to the aforementioned second condition, since already a reduction of the layer thickness by 0.015λ causes not the generation but the damping of the waves.

N. Khizhnyak

[Abstracter's note: Complete translation]

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STEPANOV, B.I.

Nonfulfillment of Bouguer's law in media with negative absorption coefficients. Dokl. AN BSSR 5 no.11:489-491 N '61. (MIRA 15:1)

1. Institut fiziki AN BSSR.

(Light)

STEPANOV, B.I.

Accumulation and emission of radiation within a parallel-plate layer.
Dokl. AN BSSR 5 no.12:541-544 D '61. (MIRA 15:1)

1. Institut fiziki AN BSSR. (Optics, Physical)

21490

S/020/61/137/004/014/031
B104/B206

244500

1158, 2106, 1395

AUTHOR: Stepanov, B. I., Academician AS BSSR

TITLE: The quantum-mechanical theory of the absorption- and luminescence spectra of complicated molecules

PERIODICAL: Doklady Akademii nauk SSSR, v. 137, no. 4, 1961, 836-839

TEXT: The author studies problems on the nature of complicated bands, analytical expressions for these bands, and the causes of the Stokes losses. The ideas of the predissociation theory developed by O. Rice (Phys. Rev., 33, 748 (1929); Phys. Rev., 15, 1551 (1930); J. Chem. Phys., 1, 375 (1953)) and Stepanov (Izv. AN BSSR, no. 5, 65 (1954)) are used for solving the problem. The solutions obtained here are accurate, but they only refer to the special case of the homogeneous problem and the "interaction" of discrete levels with a set of continuous levels of equal depth. In the case of complicated molecules, general properties of the solutions can only be formulated, permitting to clarify the experimental facts. The author assumes that the electronic excitation is coupled directly with the changes of the vibrational states of only one or several vibrational degrees of

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freedom (group A of the degrees of freedom). All other degrees of freedom act as a heat accumulator; that is that the potential functions of the upper and lower electron states differ only by the coordinates of the group A and that these potential functions are identical for the coordinates of the heat accumulator. If between group A and the other degrees of freedom no interaction takes place (zeroth approximation), the author finds that the intensity of the individual discrete lines with the frequencies $E_{el} + w^* + w$ is proportional to the square of the transition matrix elements:

$$|D_{w\omega}|^2 = \left| \int \psi_1(x) \hat{D} \psi_2^*(x) dx \right|^2 \left| \int \psi_w(q) \psi_{w^*}^*(q) dq \right|^2 = \dots \quad (2)$$

$$= |D_{12}|^2 \left| \int \psi_w(q) \psi_{w^*}^*(q) dq \right|^2.$$

ψ_1 and ψ_2 are the solutions for the Schroedinger equation of the electrons, ψ_w and $\psi_{w^*}^*$ the solutions of the vibration equation for group A. When considering a strong interaction between group A and the other degrees of freedom, the vibrational eigenfunctions are developed according to the eigenfunctions of the zeroth approximation. With it,

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